

Supplementary Information

Conductive Enhancement of Copper/Graphene Composites Based on a High-quality Graphene

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Conductivity measurement:

The measurement was carried out according to the following process:

- 1) The copper / graphene composite powders were sintered at 650 °C and 60 MPa for 5 minutes by spark plasma sintering (SPS), and the densified composite was prepared.
- 2) The composite bulk was polished by abrasive paper (from 600 mesh to 2400 mesh) and polishing powder (Al₃O₄).
- 3) A layer of gold pole was evaporated upon the composite surface by Vacuum Thermal Evaporator (JSD-300, Jiashuo, China).

4) During the measurement, two probes were contacted on the gold pole, as shown in **Figure S1**. The current-voltage curves were measured by voltammetry using a precise power source/measure unit (B2902A, Agilent, USA), and the test voltage was continuously changed from -20 mV to 20 mV in same distance. And the current-voltage curve was measured at 20 °C. The relative conductivity was calculated from the slope of current-voltage curve.



Figure S1. The gold poles on the surface of the composite

The values of pure copper and the ball milled copper powder

In order to identify the effect of the ball milling, we measured five points of original pure copper and the ball milled pure copper (before and after treatment). **Figure S2** and **Table S1** show the relative conductivities of original pure copper and the ball milled pure copper. Obviously, the results were almost the same, which meant that the ball milling seldom affected the electrical conductivity of pure copper, and the conductivity also had no relationship with the clean up in the copper oxide. Moreover, we compared the conductivity of the ball milled pure copper and the ball milled pure copper/HQG, and the experimental results also show that the copper oxide has little effect on the different conductivities of pure copper and the copper/HQG composite.

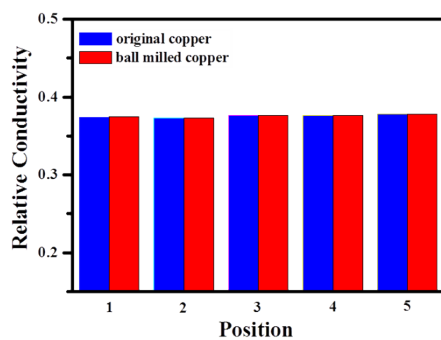


Figure S2 The relative conductivity of original pure copper and the ball milled copper

Table S1 The relative conductivity of original pure copper and the ball milled copper

Position	Original copper	Ball milled copper
1	0.37406	0.37452
2	0.37300	0.37276
3	0.37674	0.37681
4	0.37658	0.37667
5	0.37774	0.37814
Average	0.375624	0.37578